Benato, L., Rooney, N. J., & Murrell, J. C. (2019). Pain and analgesia in pet rabbits within the veterinary environment: a review. *Veterinary Anaesthesia and Analgesia*, *46*(2), 151-162. https://doi.org/10.1016/j.vaa.2018.10.007

- **Table 1: Details of physiological and behavioural changes reported in scientific studies on rabbit pain and analgesia** (NZW=New Zealand White, IV= Intravenous, IM=Intramuscular, SC=Subcutaneous, PO=Orally, d=Day, q12h=Every 12 hours, q24h=Every 24 hours, SRB= Compounded susteined-release formulation of buprenorphine, FCM= Faecal corticosterone metabolites)

Study	Rabbit number/Breed	Procedure	Analgesia	Physiological parameters	Outcome	Behavioural parameters	Outcome	Comments
Cooper et al. 2009	29/Dutch Belted	Ovariohysterectomy	3 groups: • Buprenorphine 0.03 mg/kg IM q 12h for 2 d • Meloxicam 0.2 mg/kg SC q 24h for 2 d • 0.5% bupivicane infused locally at the incision	• Haematology • Biochemestry • Body temperature • Body weight • Faecal output • Faecal flora	• No changes in body temperature, haematology, biochemestry and faecal flora during the study • Decrease in body weight and faecal output	• Food intake	• Decrease in food intake	The changes in body weight, faecal output and food intake were found to be more severe when bupivicane was used.
Leach et al. 2009	28/NZW	Ovariohysterectomy	4 groups: • Meloxicam 0.2 mg/kg PO (Loding dose) • Meloxicam 0.6 mg/kg PO (Loding dose) • Meloxicam 1mg/kg PO (Loding dose) • Control group	• Body weight	• Decrease in body weight in all animals	• Inactive pain behaviour (Twitch, wince, stagger, flinch, press, pain, adjust low, shuffle) • Other behaviours (e.g. grooming, ear position, cage position, head shaking, etc)	• Increased inactive pain behaviour • Minimal differences of the Other behaviours	Inactive pain behaviour was considered the most indicative of all the behaviours assessed during the study
Weaver et al. 2010	20/NZW	Ovariohysteretomy and telemeter implantation	4 groups: • Buprenorphine 0.02 mg/kg	• Body weight • Faecal output	• Body weight decreased significantly in all animals	• Food and water intake	• Food and water intake decreased significantly in	No statistical difference amongst the three

			• SC q12h for 3 d • Fentanyl 25-µg patch placed 24h prior surgery • Ketoprofen 1mg/kg SC q 24h for 3 d • Control group		• postoperatively up to 7 days. • Faecal output decreased significantly in all animals postoperatively	• Travel distance • Rearing activity	• all animals postoperatively • Travel distance and rearing activity decreased significantly in all animals postoperatively	analgesic groups and the control group were found during the study
Farnworth et al. 2011	7/NZW	Abdominal inplantation of a telemetric device	All animals: • Carprofen 2 mg/kg SC once	-	-	• Several behaviours were recorded post operatively (e.g. grooming, exploring, lying, etc)	Decreased behaviours: • Grooming • Food and water intake • Exploring • Stretching • Others New behaviours: • Full-body flex • Hind leg shuffle • Tight huddle Increased behaviours: • Lying • Drawing back • Staggering • Closed eyes	The authors stated that behavioural indicators of pain may differ depending on housing and surgical procedure
Keating et al. 2012	8/NZW	Ear tattoing	4 groups: • Sham tatooing with EMLA cream ® • Sham tatooing without EMLA cream ® • Tatooing with EMLA cream ® • Tatooing without EMLA cream ®	• Heart rate • Arterial blood pressure • Serum corticosterone concentration	All the animals tattooed without EMLA cream: • Increased heart rate • Increased arterial blood pressure All animals with or without the EMLA cream ®: • Increased Serum corticosterone concentration	• Facial expression • Grooming • Movement • Rearing • Vocalisation and struggling	• Increased grooming was noticed only in the animals tattooed without EMLA cream ® • Movement and rearing decreased in all animals • Rearing, vocalisation and struggling was noticed in	The Rabbit Grimace Scale developed during this study provides a validated pain assessment tool in rabbits.

								animals tattooed without EMLA cream ®	
Goldschlager et al. 2013	39/NZW	Vascular cut-down of the femoral artery	4 groups: • Buprenorphine 0.03 mg/kg SC q12h for 3 d • Meloxicam 0.2 mg/kg SC q24h for 3 d • Buprenorphine 0.01 mg/kg and meloxicam 0.1 mg/kg SC q 24h for 3 d • Single dose of 0.5 ml of 0.5% bupivicane infused locally	• Faecal corticosterone metabolites (FCM) • Faecal ouput • Urine output • Body weight • Haematology • Biochemestry • Faecal flora	In the buprenorphine-meloxicam group, FCM did not change while it increased in the other 3 groups In all animals: • Dedreased faecal output • Normal urine output • Decreased body weight • Normal range of haematology and biochemestry • Normal faecal flora	• Food intake	All animals showed a decrease in food intake		The study suggests that a multimodal approach using a combination of buprenorphine and meloxicam may control pain better than meloxicam or buprenorphine given alone.
Hedenqvist et al. 2016	18/NZW	Bilateral axillary sinus augmentation	2 groups: • Buprenorphine 0.03mg/kg IV and 0.02 mg/kg SC (Loding dose) and carprofen 5 mg/kg SC q 24 h for 4 d • Buprenorphine 0.03mg/kg IV and 0.02 mg/kg SC (Loding dose) and saline (NaCl)	• Body weight	• No difference between the two groups	• Facial expressions	• No differences between the two groups were found		Facial expressions such as orbital tightening and ear positions were considered easy to evaluate by inexperienced people during the study
DiVincenti et al. 2016	24/NZW	Tibial titanium implants	2 groups: • Buprenorphine 0.02 mg/kg SC q12 h for 3 d	-	-	• Grimace scale score • Acivity score	In both groups: • Increased in Grimace score • Decreased in activity score		The two treatment groups were comparable during the

	• Compounded susteined-release formulation of buprenorphine (SRB) 0.12 mg/kg once		study with no major adverse affects reported